

# Long-Lived Farm Animals As Capital Assets

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### Why Capitalize Long-Lived Working Livestock?

- Long-Lived Working Livestock function in production similarly to other capital
  - Early in their life, working livestock are costly to raise and produce no output.
  - Once mature, working livestock produce useful services over multiple periods.
  - Working livestock eventually deteriorate and are discarded.
- Experts Recommend Capitalizing Working Livestock
  - The 2014 Review Report recommended capitalizing breeding livestock (Shumway, et. al 2014)
  - The System of National Accounts 2008, the international guideline for GDP, recommends capitalizing livestock
  - We follow the methodology outlined in 'Neoclassical Capital Measures Using Vintage Data: An Application to Breeding Livestock' (Ball and Harper 1990)

# Impacts of Capitalizing Working Livestock

- Livestock Capital is Both Farm Output and Input
- Measured Farm Output Increases
  - Working livestock represent own-account capital formation by the farm sector, and so are part of farm output
- Measured Farm Inputs Increase
  - Working livestock provide capital services to the farm sector, and so are part of farm input.
  - On the other hand, we're removing working livestock from the inventory, so capital services from inventory decrease.
- Measured Farm Inventories Decrease
  - ERS currently tracks livestock in farm inventory.
  - We are working to recalculate farm inventory when long-lived working animals are tracked as depreciable capital assets.

### Change to Measured TFP from Capitalizing Livestock



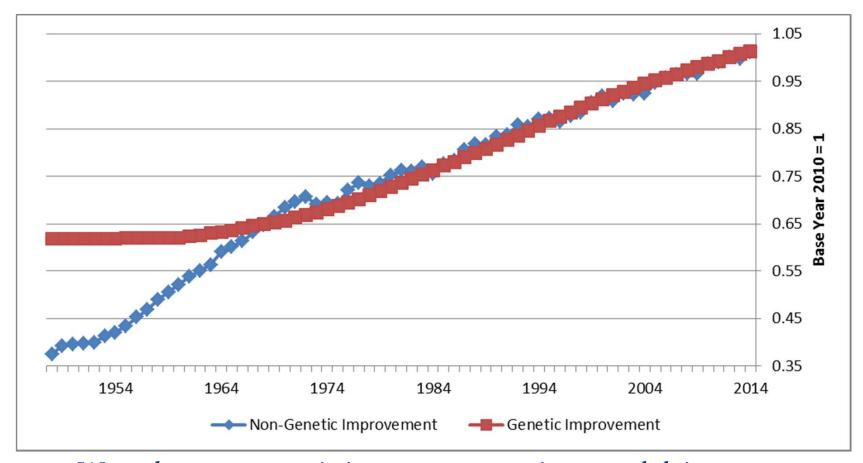
- Change in accounting approach leads to slower TFP growth from 1948 to 2013
  - We show cumulative TFP growth, so the effects grow over time.

## Important Issues For Capitalizing Livestock

- We Capitalize Two Main Animal Categories:
  - a) Dairy Cows and b) Breeding Beef Cows
- Quality Improvement Over Time
  - We only count genetic improvement as increased animal quality. We assume that quality is linear with genetics.
  - Non-genetic improvement is considered general TFP.
- Age/Efficiency Profile for Each Category
  - Individually, older cows are more productive than new heifers. However, cohort size shrinks steadily with mortality.
- Two Methods for Measuring Capital Stock:
  - Perpetual Inventory Method assumes fixed mortality rates.
  - Ball/Harper Method allows for changing mortality rates



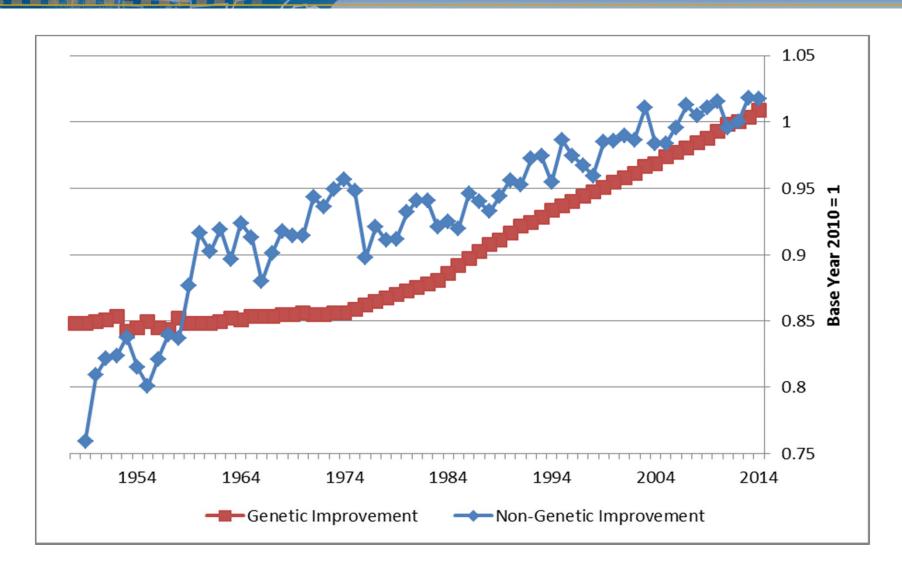
# Dairy Cow Genetic Improvement vs. Other Contributions to Milk Yield



- We only count genetic improvement as increased dairy cow quality. Non-genetic improvement is considered general TFP.
- We assume that cow quality is linear with milk production
  - Measured TFP growth is not sensitive to changes in cow quality methodology

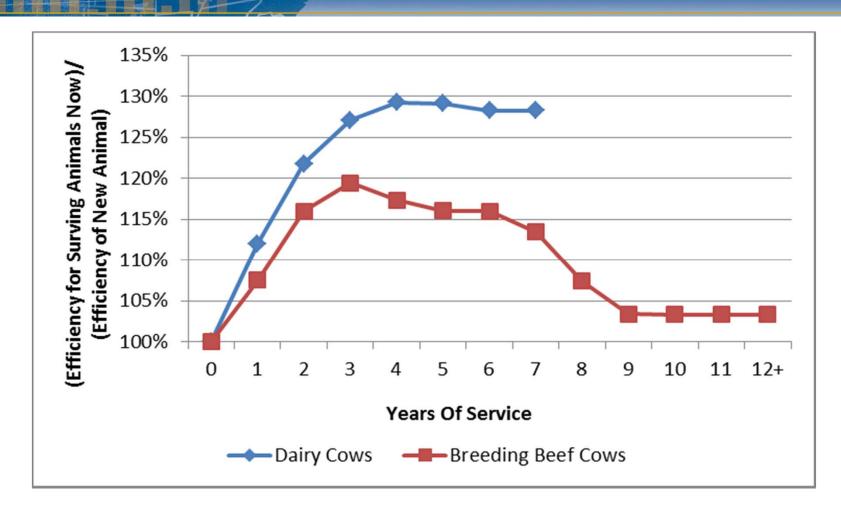








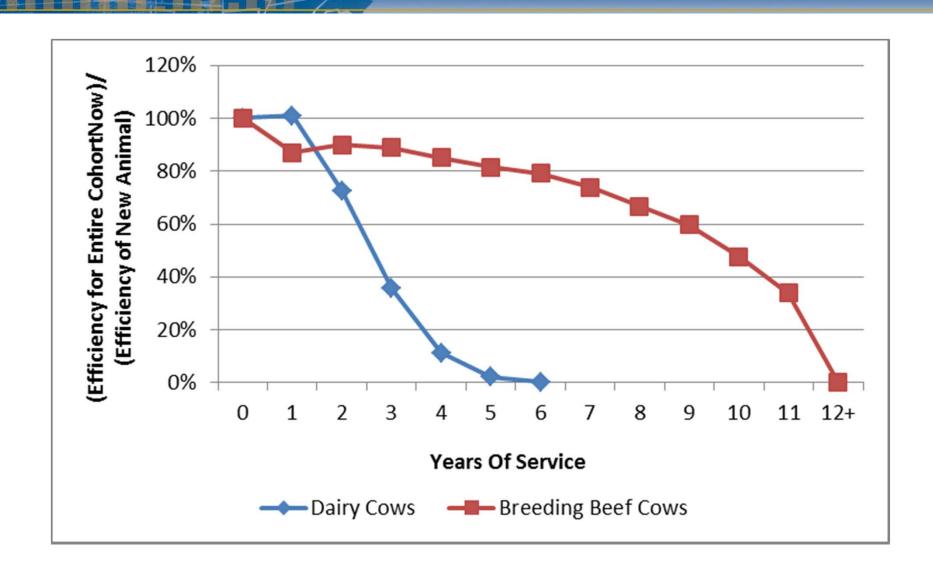
### Age/Efficiency For Surviving Animals



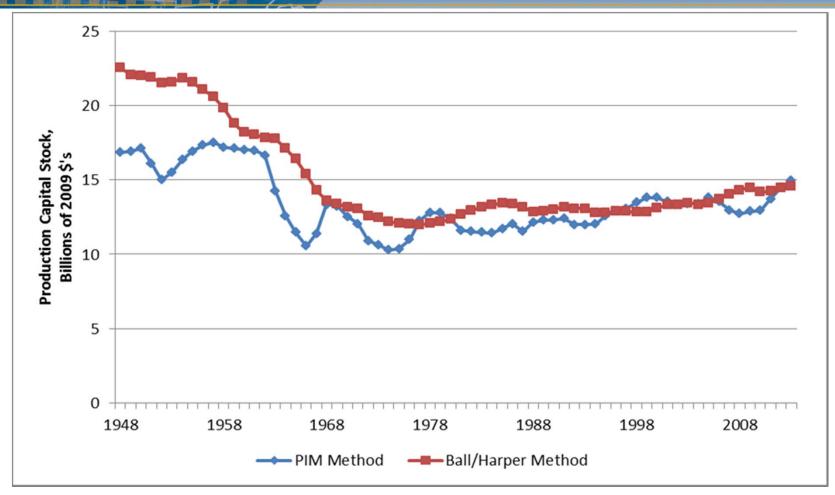
 Older animals have much higher mortality rates, and so market value decreases steadily with age.



### Age/Efficiency by Cohort Age

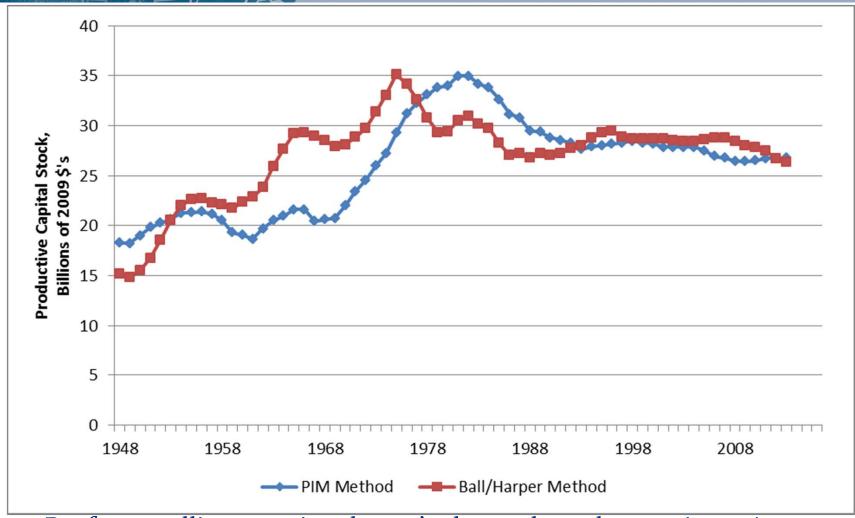






• Before the 1970's, farmers were much less aggressive when culling their dairy herd. As a result, the perpetual inventory method underestimates the capital stock then.





 Beef cow culling practices haven't changed much over time. As a result, both methods produce similar results.



### Annual Data is Available Upon Request

Table 5: Investment, Prices, Stock and Deterioration of Dairy Cows

	Population, in 2012 New cow units				Dairy Cow Prices			Nominal Values (Billions of \$'s)			
	Product				Daily Cow Files			ivorninai values (Billions of \$'s)			
	Genetic	ive Stock	Produc tive			Adjust ed for				Implied	Invent ory
	Quality Index	(Ball/Ha rper)	Stock (PIM)	Wealth Stock	Per Head	Qualit y	Price Index	Invest ment	Capital Stock	Deprec iation	Adjust ment
2014	101.31%	10,305	10,573	8,802	1,451	1,432	100.9	-	12.60	-	
2013	100.68%	10,277	10,545	8,724	1,380	1,371	96.6	4.85	11.96	4.74	0.01
2012	100.00%	10,215	10,183	8,664	1,430	1,430	100.8	4.75	12.39	4.66	-0.08
2011	99.22%	10,083	9,672	8,507	1,420	1,431	100.9	4.75	12.17	4.52	-0.05
2010	98.63%	10,040	9,124	8,331	1,330	1,348	95.1	4.49	11.23	4.25	0.16
2009	98.00%	10,248	9,081	8,497	1,390	1,418	100.0	3.95	12.05	4.18	-0.04
2008	97.28%	10,122	8,977	8,359	1,950	2,005	141.3	5.84	16.76	5.57	-0.08
2007	96.47%	9,914	9,143	8,193	1,830	1,897	133.8	5.29	15.54	4.97	-0.04
2006	95.75%	9,696	9,535	8,114	1,730	1,807	127.4	4.71	14.66	4.57	-0.03
2005	95.13%	9,473	9,754	8,055	1,770	1,861	131.2	5.01	14.99	4.90	-0.01
2004	94.47%	9,428	9,453	7,945	1,580	1,673	117.9	5.34	13.29	5.16	0.09
2003	93.60%	9,503	9,441	8,008	1,340	1,432	100.9	4.13	11.47	4.23	-0.02
2002	92.77%	9,405	9,407	7,907	1,600	1,725	121.6	5.12	13.64	4.94	0.03
2001	91.99%	9,392	9,544	7,902	1,500	1,631	115.0	4.68	12.89	4.67	0.00
2000	91.24%	9,269	9,726	7,859	1,340	1,469	103.6	4.14	11.54	4.07	-0.03
1999	90.38%	9,073	9,732	7,755	1,280	1,416	99.9	4.11	10.98	3.96	0.03
1998	89.44%	9,054	9,497	7,716	1,120	1,252	88.3	3.84	9.66	3.79	0.04
1997	88.45%	9,104	9,224	7,690	1,100	1,244	87.7	3.82	9.56	3.79	0.04
1996	87.52%	9,104	9,085	7,687	1,090	1,245	87.8	3.55	9.57	3.54	0.02
1995	86.61%	9,061	8,876	7,660	1,130	1,305	92.0	3.65	9.99	3.62	0.02
1994	85.65%	9,056	8,473	7,551	1,170	1,366	96.3	4.07	10.31	3.92	0.14
1993	84.63%	9,259	8,462	7,694	1,160	1,371	96.6	3.57	10.55	3.76	0.04
1992	83.59%	9,253	8,448	7,643	1,130	1,352	95.3	3.63	10.33	3.56	0.13
1991	82.73%	9,322	8,735	7,777	1,100	1,330	93.8	3.18	10.34	3.36	0.00
1990	81.65%	9,209	8,689	7,678	1,160	1,421	100.2	3.85	10.91	3.71	0.03
1989	80.68%	9,129	8,663	7,641	1,030	1,277	90.0	3.34	9.75	3.29	0.05
1988	79.86%	9,076	8,577	7,636	990	1,240	87.4	3.22	9.47	3.21	0.14
1987	78.95%	9,356	8,128	7,647	920	1,165	82.2	3.56	8.91	3.57	0.16
1986	78.05%	9,481	8,498	7,878	820	1,051	74.1	2.26	8.28	2.51	0.06
1985	77.24%	9,536	8,262	7,881	860	1,113	78.5	3.01	8.77	3.02	0.00
1984	76.33%	9,479	8,060	7,781	895	1,173	82.7	3.14	9.12	3.02	-0.01
1983	75.43%	9,327	8,089	7,690	1,030	1,365	96.3	3.32	10.50	3.20	-0.02
1982	74.48%	9,153	8,132	7,579	1,110	1,490	105.1	3.66	11.30	3.49	-0.06
1981	73.63%	8,955	8,184	7,376	1,200	1,630	114.9	4.28	12.02	3.94	-0.03

Table 6: Investment, Prices, Stock and Deterioration of Breeding Beef Cows

	Populatio	n, in 2012 N	lew cow		2 (0 2:			N 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
	units Product				Beef Cow Prices			Nominal Values (Billions of \$'s)			
	Genetic Quality	ive Stock	Produc tive Stock	Wealth	Per	Adjust ed for Qualit	Price	Invest	Carital	Implied	Invent ory
	Index	(Ball/Ha rper)	(PIM)	Stock	Head	y	Index	ment	Capital Stock	Deprec iation	Adjust ment
2014	100.88%	31,875	32,360	25,285	1,801	1,786	217.0	-	45.55	-	-
2013	100.35%	32,020	32,507	25,389	1,290	1,286	156.2	4.67	32.76	4.64	0.60
2012	100.00%	32,495	32,495	25,781	1,237	1,237	150.4	4.36	31.90	4.74	0.96
2011	99.82%	33,362	32,467	26,431	1,118	1,120	136.1	4.06	29.55	4.74	0.44
2010	99.30%	33,775	32,197	26,630	939	946	115.0	3.72	25.02	3.78	0.23
2009	98.77%	33,997	32,103	26,714	813	823	100.0	3.14	21.71	3.09	0.40
2008	98.42%	34,607	32,140	27,086	862	876	106.4	3.24	23.35	3.48	0.28
2007	98.07%	34,957	32,504	27,340	911	929	112.9	3.23	24.91	3.37	0.06
2006	97.72%	34,969	32,744	27,317	894	915	111.2	3.29	24.42	3.18	-005
2005	97.37%	34,754	33,445	27,270	921	946	114.9	3.09	25.11	2.96	-0.03
2004	96.84%	34,554	33,821	27,217	858	886	107.7	3.02	23.36	2.85	0.08
2003	96.67%	34,577	33,848	27,211	755	781	94.9	2.94	20.55	2.90	0.0
2002	96.14%	34,647	33,821	27,216	653	680	82.6	2.56	17.78	2.47	0.12
2001	95.79%	34,854	33,825	27,372	718	750	91.1	2.71	19.66	2.75	0.08
2000	95.44%	34,896	34,269	27,534	696	730	88.7	2.45	19.17	2.49	0.08
1999	95.09%	34,918	34,356	27,652	606	638	77.5	2.27	16.76	2.28	0.06
1998	94.74%	34,910	34,579	27,672	555	586	71.2	2.24	15.37	2.20	0.14
1997	94.39%	35,133	34,355	27,837	592	627	76.2	2.45	16.48	2.49	0.36
1996	94.04%	35,864	34,201	28,378	469	498	60.5	1.95	13.30	2.15	-0.02
1995	93.68%	35,593	34,056	28,153	536	572	69.5	2.30	15.08	2.12	-0.19
1994	93.33%	34,926	33,885	27,619	598	640	77.8	2.57	16.51	2.18	-0.35
1993	92.81%	34,040	33,573	26,794	674	726	88.2	3.12	18.05	2.46	-0.06
1992	92.46%	33,751	34,308	26,637	634	686	83.4	2.41	16.90	2.24	-0.26
1991	92.18%	33,113	34,705	26,199	680	738	89.7	2.67	17.82	2.32	-0.04
1990	91.63%	32,893	34,979	26,047	673	734	89.2	2.69	17.52	2.48	0.18
1989	91.08%	33,045	35,675	26,293	619	680	82.6	2.31	16.28	2.37	-0.21
1988	90.80%	32,560	35,866	25,864	588	647	78.7	2.63	15.20	2.33	0.33
1987	90.26%	33,032	37,422	26,368	532	590	71.7	2.00	14.03	2.19	-0.07
1986	89.71%	32,836	37,856	25,967	429	478	58.1	2.22	11.14	1.98	0.64
1985	89.16%	34,315	39,630	27,205	429	481	58.5	1.57	11.68	2.03	0.78
1984	88.62%	36,167	41,042	28,655	433	489	59.4	1.77	12.42	2.33	0.21
1983	88.08%	36,630	41,523	28,979	419	475	57.8	1.98	12.13	2.04	0.48
1982	87.81%	37,640	42,476	29,928	428	487	59.2	1.77	12.81	2.14	-0.23
1981	87.54%	37,065	42,485	29,508	434	495	60.2	2.20	12.79	1.98	-0.69



#### Adjusting Farm Inventories

- ERS and BEA currently count dairy cows and beef cows in farm inventories.
  - Changes to livestock inventory are included in farm output.
- We adjust inventory to avoid double-counting.
  - NASS currently reports the aggregate value of livestock inventory and the value of 'changes to livestock inventory'.
  - If NASS published values by category, then it would be straightforward to recalculate farm inventory when dairy cows and beef cows are capitalized.
  - Unfortunately, NASS doesn't published value by category.
     For now, we value cows based on their slaughter value.